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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/689,167	10/20/2003	Heinz H. Busta	100077	6389

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EXAMINER	
FULK, STEVEN J	
ART UNIT	**PAPER NUMBER**
2891	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	04/27/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/689,167	BUSTA, HEINZ H.	
	Examiner	Art Unit	
	Steven J. Fulk	2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 February 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *11,12,14-21,24-31,33-35,38,39,42-55 and 57* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *11,12,14-21,24-31,33-35,38,39,52-55 and 57* is/are rejected.

7)☒ Claim(s) *42-51* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment filed February 23, 2007, which amends claims 11, 39 and 52, cancels claims 1-3, 6, 10, 13, 22-23, 32, 36-37, 40 and 56, has been entered. Claims 4-5, 7-9 and 41 were previously canceled. Claims 11-12, 14-21, 24-31, 33-35, 38-39, 42-55 and 57 are currently pending.

Claim Objections

2. Claim 24 is objected to because it depends from a canceled claim. Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 39 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 39 recites the limitation "said surface". There is insufficient antecedent basis for "said surface" in the claim.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 11, 12, 14-17 and 27 are rejected under 35 U.S.C. 102(e) as being anticipated by Ma et al. '022.

a. Regarding claims 11-12, 14 and 27, Ma et al. discloses a MEM device comprising a movable mechanism (fig. 12, 370A) residing adjacent a substrate (310); a diamond abrasion resistant material (fig. 19, coating 350) localized on a first portion of the movable mechanism (fig. 12, contact 365 on movable mechanism 370A); and a first contact region localized on the substrate (fig. 12, 320B) used to attract the movable mechanism towards the substrate such that the abrasion resistant material becomes operationally coupled to a second contact region (320C) residing on the substrate, wherein the abrasion resistant material is disposed along the first portion of the movable mechanism, the first portion subject to abrasion as the abrasion resistant material becomes operationally coupled to the second contact region (col. 3, lines 57-65; col. 4, lines 63-67; contact 365 is coated with diamond layer 350 to prevent wear).

b. Regarding claims 15-16, the reference discloses second contact region comprises an abrasion resistive material similar to the abrasion resistive material localized on a portion of the movable mechanism (Abstract, multiple

contact surfaces coated with diamond; fig. 1, second contact region 120C coated with diamond layer 140C).

c. Regarding claim 17, the reference discloses second contact region comprises a first RF contact portion and a second RF contact portion such that when the movable mechanism is attracted towards the substrate, the abrasion resistive material shorts the first RF contact portion and second RF contact portion (col. 1, lines 11-17, RF switch device; col. 3, lines 57-65, contact 365 shorts to 320C).

7. Claims 52-55 and 57 are rejected under 35 U.S.C. 102(b) as being anticipated by Lin et al. '082.

Regarding claims 52-54 and 57, Lin et al. '082 discloses a method of fabricating a micro-machined apparatus comprising the steps of providing a substrate (fig. 7Q, layer supporting structure 450); fabricating a vertical substrate structure (450) extending from the substrate; and fabricating a cover substrate structure (fig. 7R, 456) residing on a portion of the substrate structure and defining a tortuous, labyrinth channel (channel 458), and removing sacrificial material (fig. 7Q, 452) internal to the enclosure through the tortuous channel (col. 11, lines 13-37).

Regarding claim 55, the reference discloses the step of enclosing a plurality of MEM devices in the micro-machined apparatus (col. 11, lines 35-37, plurality of micromechanical components being sealed).

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 11, 12, 14, 17-19, 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. '611 in view of Ma et al. '022.

a. Regarding claims 11, 12, 14 and 27, De Los Santos et al. discloses a MEM device comprising a moveable mechanism (fig. 2, 28) residing adjacent a substrate (22); a gold material localized on a first portion of the movable mechanism (30b); a first contact region localized on the substrate (38b) that attracts the moveable mechanism toward the substrate such that the gold material becomes operationally coupled to a second contact region residing on the substrate (24b). De Los Santos et al. also discloses the first portion to be subject to abrasion as the gold material becomes operationally coupled to the second contact region (fig. 2, abrasion inherently occurs as pads 30b and 24b come into contact).

De Los Santos et al. does not explicitly disclose forming an abrasion resistant material over the gold contact. Ma et al. discloses a MEM device comprising a movable mechanism (fig. 12, 370A) residing adjacent a substrate (310); a diamond abrasion resistant material (fig. 19, coating 350) covering a gold contact (fig. 12, 365; col. 5, lines 15-16, gold material) localized on a first portion of the movable mechanism (fig. 12, contact

370A); and a first contact region localized on the substrate (fig. 12, 320B) used to attract the movable mechanism towards the substrate such that the abrasion resistant material becomes operationally coupled to a second contact region (320C) residing on the substrate, wherein the abrasion resistant material is disposed along the first portion of the movable mechanism, the first portion subject to abrasion as the abrasion resistant material becomes operationally coupled to the second contact region (col. 3, lines 57-65; col. 4, lines 63-67; contact 365 is coated with diamond layer 350 to prevent wear).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the diamond abrasion resistant coating of Ma et al. on the contact of De Los Santos et al. One would have been motivated to do this because Ma et al. taught that diamond coatings on gold contacts to protect the contacts from wear (col. 3, lines 57-65), thus extending the usable life of the contact and improving the performance of the device.

b. Regarding claims 17-18, De Los Santos et al. discloses the second contact region to comprise a first RF contact portion and a second RF contact portion, such that the movable mechanism shorts the first and second RF contacts (fig. 7, 24b; RF IN & OUT); and a third contact region operable to pull back the moveable mechanism from being attracted to the second contact region (fig. 2, 38a).

c. Regarding claim 19, De Los Santos et al. further discloses the moveable mechanism to comprise a first anchor portion (fig. 2, 34) and a second anchor portion (36) integral to a top surface of the substrate.

d. Regarding claim 28, De Los Santos et al. further discloses a dielectric layer (fig. 17, 64) deposited along the surface of the substrate such that when the first contact region is energized, the moveable mechanism (60) is not physically coupled to the second contact region (64 covers second contact 54 from being engaged with mechanism 60).

7. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al. '022 in view of Lin et al. (NPL Reference "U", previously provided).

Ma et al. discloses all of the elements of the claim(s) as set forth in paragraph 4 above, and the reference also discloses the movable mechanism to comprise a metallic layer (fig. 12, 370A), but the reference does not explicitly disclose the movable mechanism to comprise a second surface defining a rib. Lin et al. discloses a movable mechanism with a second surface defining an integral rib. (fig. 1; page 93-95, section 2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the rib enforced mechanism of Lin et al. in the switch mechanism of Ma et al. One would have been motivated to do this because Lin et al. taught that the standard levers used in switches become deformed under electrostatic forces, such as the forces applied by Ma et al. to operate the switch (col. 1, lines 60-66), and using a rib enforced lever reduces this deformation (Lin et

al., page 93, section 1, rib-reinforced structure has less deformation under external loads), thus improving the performance of the device.

8. Assuming claim 24 is to be dependent from claim 21, claims 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al. '022 in view of Lin et al. (NPL Reference "U"), and further in view of Daneman et al. '887.

Ma et al. in view of Lin et al. discloses all of the elements of the claim(s) as set forth in paragraph 7 above, but the reference does not explicitly disclose an integral enclosure that electrically shields and encloses the MEM device. Daneman et al. teaches a MEM device comprising a movable micro-machined structure with an integral enclosure that electrically shields and encloses the MEM device (fig. 10A-10F, electrically shielding insulating layer 1010 is integrally formed on top of MEM device layer 1002, col. 11, lines 28-59).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the integral enclosure of Daneman et al. in the device as described by Ma et al. in view of Lin et al. One would have been motivated to do this because it was well known in the art that the insulating enclosure would have both reduced the switch's susceptibility to electrical noise and protected it from environmental conditions, such as moisture and contamination, thus improving the performance of the device.

9. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. '611 in view of Ma et al. '022, further in view of Lin et al. (NPL Reference "U"), and further in view of Daneman et al.

a. De Los Santos et al. in view of Ma et al. discloses all of the elements of the claim as set forth in paragraph 6 above, including a movable mechanism with an abrasion resistant material localized on the movable mechanism and a pull-back contact region located on the substrate, but the references do not explicitly disclose the movable mechanism to comprise a second surface defining a rib. Lin et al. discloses a movable mechanism with a second surface defining an integral rib. (fig. 1; page 93-95, section 2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the rib enforced mechanism of Lin et al. in the switch mechanism of De Los Santos et al. in view of Ma et al. One would have been motivated to do this because Lin et al. taught that the standard levers used in switches become deformed under electrostatic forces, such as the forces applied to operate the switch, and using a rib enforced lever reduces this deformation (Lin et al., page 93, section 1, rib-reinforced structure has less deformation under external loads), thus improving the performance of the device.

b. De Los Santos et al. in view of Ma et al. discloses all of the elements of the claim as set forth in paragraph 6 above, but the references do not explicitly teach an integral enclosure that electrically shields and encloses the MEM device. Daneman et al. teaches a MEM device comprising a movable micro-machined structure with an integral enclosure that electrically shields and encloses the MEM device (fig. 10A-10F, electrically shielding insulating

layer 1010 is integrally formed on top of MEM device layer 1002, col. 11, lines 28-59).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the integral enclosure of Daneman et al. in the device as described by De Los Santos et al. in view of Ma et al. One would have been motivated to do this because it was well known in the art that the insulating enclosure would have both reduced the switch's susceptibility to electrical noise and protected it from environmental conditions, such as moisture and contamination, thus improving the performance of the device.

10. Claims 29-31, 34, 35 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. '611 in view of Lin et al. (NPL Reference "U").

De Los Santos et al. discloses a MEM switching device comprising a lever mechanism (fig. 2, 28) residing along a surface of a substrate, the lever mechanism having a planarized surface and having at least one anchor lever mechanism (32) portion extending from the surface; a first contact region deposited on the substrate (38b), the first contact region for attracting the lever mechanism towards the substrate such that the lever mechanism becomes electrically coupled to a third contact region that comprises a planar conductive composition layer (planar contact 24b); and a second contact region (38a) that pulls back the lever mechanism from being electrically coupled to the third contact region; and first and second micro-strip contact lines (fig. 7, 24b; RF IN & OUT).

De Los Santos et al. does not explicitly disclose the surface to define an integral rib. Lin et al. discloses a movable mechanism with a second surface defining an integral rib. (fig. 1; page 93-95, section 2).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the rib enforced mechanism of Lin et al. in the switch mechanism of De Los Santos et al. One would have been motivated to do this because Lin et al. taught that the standard levers used in switches become deformed under electrostatic forces, such as the forces applied by De Los Santos to operate the switch (col. 4, lines 41-47), and using a rib enforced lever reduces this deformation (Lin et al., page 93, section 1, rib-reinforced structure has less deformation under external loads), thus improving the performance of the device.

11. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. '611 in view of Lin et al. (NPL Reference "U"), and further in view of Ma et al. '022.

De Los Santos et al. in view of Lin et al. discloses all of the elements of the claim(s) as set forth in paragraph 9 above, but the references do not explicitly disclose the conductive layer to comprise diamond. Ma et al. discloses a MEM device comprising a movable mechanism (fig. 12, 370A) residing adjacent a substrate (310) with a conductive diamond layer (fig. 19, coating 350).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the diamond abrasion resistant coating of Ma et al. on the contact of De Los Santos et al. in view of Lin et al. One would have been motivated to do this because Ma et al. taught that diamond coatings protect the

contacts on the movable arm from wear (col. 3, lines 57-65), thus extending the usable life of the contact and improving the performance of the device.

Response to Arguments

12. Applicant's arguments with respect to the rejection of claim 11, 12, 14-17 and 27 under 35 U.S.C. 102(e) as being anticipated by Ma et al. have been fully considered but they are not persuasive. Applicant argues that Ma et al. does not teach a first portion subject to abrasion as the abrasion resistant material becomes operationally coupled to the second contact region. This argument is not found persuasive because Ma et al. taught that the surfaces of the contacts are subject to wear as they come into contact with each other (col. 3, lines 57-65), and the wear was inherently due to abrasion of the surfaces against each other.

13. Applicant's arguments with respect to the rejections under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. in view of Lin et al. (NPL reference) have been fully considered but they are not persuasive. Applicant argues that De Los Santos improves the switch by controlling the actuation voltage, and does not rely on the stiffness of the beam to improve the device. While the Examiner agrees that De Los Santos controls the switch frequency by controlling the actuation voltage (col. 4, lines 58-60), the teaching of Lin et al. that cantilever switches are susceptible to deformation and buckling due to thin-film residual stress and due to external load forces (actuation voltages) provides motivation to use the rib structure of Lin et al. in the cantilever device of De Los Santos et al. to reduce deformation under either stress condition (Lin et al., page 93, section 1, rib-

reinforced structure has less deformation under residual stress and external loads, which would inherently extend the useable life of the switch.

14. Applicant's arguments with respect to the rejections under 35 U.S.C. 103(a) as being unpatentable over De Los Santos et al. in view of Daneman et al. have been fully considered but they are not persuasive. Applicant argues that Daneman et al. does not teach an integral enclosure, rather that figures 10A-10F depict the fabrication of the MEM device shown in figure 9. The Examiner agrees that figures 10A-10F depict the fabrication process, however the figures show the MEM device of figure 9 as a schematic block in fig. 10B (col. 11, lines 28-30, schematic diagrams, device layer 1002), thus figures 10A-10F depict the enclosing and electrical connection of the devices. The integral enclosure layer 1010 is formed between devices and on the surfaces of the devices (col. 11, lines 34-37), thus enclosing the devices. Enclosure layer 1010 is insulating, and thus inherently acts as an electrical shield. Applicant argues that there is no mention in the prior art that the integral enclosure would improve the invention of De Los Santos. However, it is well known in the art that enclosures are necessary to protect MEMS devices from environmental conditions to perform their intended functions, and the enclosure of Daneman would have provided a simplified process of depositing an integral insulating layer during fabrication as opposed to bonding an insulating cap at a later point.

15. Applicant also argues that De Los Santos et al. describes controlling the speed of the contact to extend the contact life, thereby providing no motivation to use a conductive layer comprising diamond. However, De Los Santos describes

controlling the actuation voltage to control the device frequency, which does not alleviate the problem of contact wear taught by Ma et al. Therefore, the motivation to use a conductive layer comprising diamond is provided by Ma et al., which is to protect contacts from wearing out.

16. Upon further consideration, claim 52 is not considered to be allowable, and is rejected under 35 U.S.C. 102(b) as being anticipated by Lin et al. '082, as set forth above.

Allowable Subject Matter

17. Claims 42-51 are objected to as being dependent upon a rejected base claim, but would be allowable if claim 39 was rewritten to overcome the 35 U.S.C. 112, 1st paragraph rejection as set forth above.

18. The following is an examiner's statement of reasons for indicating allowable subject matter: a search of the prior art failed to disclose or reasonably suggest a micro-machined structure for enclosing a MEMS device comprising a structure extending from a substrate and at least partially covering the MEMS device; a cover structure residing on a portion of the substrate structure; a contact region provided on the cover substrate structure, acting as a pull-back contact for a MEM device residing on the substrate; and wherein the micro-machined structure defines at least one tortuous path capable of providing for a removal of material, as recited by claim 39.

Conclusion

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven J. Fulk whose telephone number is (571)

272-8323. The examiner can normally be reached on Monday through Friday, 9:30am to 6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

SJF

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April 24, 2007

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